Fire / Fuels and Air Quality

Resource Reports

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3.9 Fire and Fuels

The fire and fuels analysis focuses on potential changes as they relate to activity categories #13 Juniper Tree Removal and #14 Riparian Vegetation Treatment (prescribed fire) adjacent or near stream channels. It is unlikely that individual prescribed fires will occur within riparian corridors without also including the adjacent uplands. Discussing the upland areas is outside of the scope of this analysis but would be addressed in a separate and complementary NEPA document. Implementing the two activities would result in changes in fuel characteristics. These changes will impact fire behavior and fire severity within these riparian habitats and connected uplands. This section will also analyze potential impacts to fire and fuels if the proposed Action is not implemented.

Best Management Practices (BMPs) and Project Design Criteria (PDC) would be followed so there would be no permanent impairment to these ecosystems as a result of treatments.

3.9.1- Relevant Laws, Regulations, Policies, Guidance, and Plans- Fire and Fuels

The Umatilla National Forest Land and Resource Management Plan 1990 as amended (LRMP) provides standards and guidelines for fire and fuels management. Other regulations and policies considered in this analysis include:

- National Forest Management Act
- National Fire Plan
- National Cohesive Wildland Fire Management Strategy

3.9.2 Methodology- Fire and Fuels

The basis of the effects analysis is the observations, experience, and professional judgment of the Fire and Fuels Specialist, in conjunction with best available science. The scale of the analysis is the riparian habitat corridor areas in dry forest types, fire regimes one and two, within the bounds of the Umatilla National Forest.

This report will use Fire Regime Condition Class (FRCC) to indicate the effect the above treatments will have on the natural fire regime. FRCC will be measured by acres treated in two types of treatments; restoration and maintenance. The ecological diversity of riparian ecosystems is maintained by natural disturbance regimes (Naiman, 1993), including fire and fire-related flooding, debris flows and landslides. Moving the landscape towards its natural fire regime would bring back vegetative diversity and the landscapes ability to endure future disturbance events.

3.9.3 Affected Environment - Fire and Fuels

Throughout the Umatilla National forest, wildland fire processes have been altered due to fire exclusion, timber harvest, climate change, and grazing. As a result, fires are now larger and more severe than historic levels, especially in the dry forest types (Quigley & Arbelbide, 1997). Forest structure has been altered. Juniper forests in a 1936 study covered only 420,000 acres in eastern Oregon but today cover 2.2 million acres (Gedney, Azuma, Bolsinger, & McKay, 1999). Juniper encroachment has increased more than 500% in the Blue Mountains since the 1930s (Gedney, Azuma, Bolsinger, & McKay, 1999).

With this increase in Juniper across the landscape it is important to understand its fire ecology. As the crown of an established western juniper expands over time, herbaceous production declines from the combined effects of shading, litter accumulation, and soil moisture. Trees create their own fine fuel break, so these stands may be virtually "fireproof" except under the most severe burning conditions. Often mature open stands can be used as fuel breaks. Many western juniper woodlands have advanced to a point where prescribed fire is no longer a viable management option. For example, in extremely dense stands, prescribed burning would be both hazardous and expensive (Tirmenstein, 1999). These mature stands also limit the effectiveness of wildfire ever being a change agent to reset the plant communities. Western juniper first becomes dominant 30 to 50 years after fire. Young western junipers have thin bark and are readily killed by surface fires. Reoccupation of a site occurs relatively slowly through dispersed seed. These systems need recurring fire to be maintained and or mechanical removal of juniper to restore historic species composition.

Studies have specifically shown hardwood tree and shrub-dominated riparian zones to have declined since the mid-1800s (Lee, Sedell, & Rieman, 1997); (Wisdom, 2000) throughout the Blue Mountains. Many of these areas succeeded into dense stands of fir where shade intolerant shrubs may be absent or in decline (Liquori, 2001). Ultimately, these changes have created a set of systems that are less resilient in the wake of disturbances, such as periodic native insect infestations or recurring wildfires. The overabundance of conifers into riparian areas has changed the ground water and vegetation dynamics within these ecosystems, see hydrology and fish specialist reports.

Riparian areas frequently differ from adjacent uplands in microclimate, and fuel characteristics. These features may contribute to different fire environments, fire regimes, and fire properties (frequency, severity, behavior, and extent) in riparian areas relative to uplands. Moisture content within the fuels can be considerably higher due to factors like relative humidity, available groundwater, topography, and shading. Riparian areas can be impediments to fire spread and fire refugia. Fire refugia are areas with lower effects than the surrounding area, where biota can persist and expand from during and after a fire event. The reduction of riparian habitat and the encroachment of conifers into these systems have blurred the lines between how a fire may effect upland and riparian ecosystems.

Fire Regimes

Fire regimes are the classification of the historic combined conditions for fire severity, intensity, and frequency for a particular environment (Agee J. , 1993); (Hann, 2001). They are a cornerstone for describing the natural range of variability within a system. In certain forested riparian areas, fire frequency has generally been lower, and fire severity has been more moderate than in adjacent uplands, but in other areas, fires have appeared to burn riparian areas with comparable frequency (Dwire, 2003).

The regime that is addressed in the two action items is predominately Fire Regime I. In these drier forest types, fire return intervals were generally similar in upland and riparian stands, indicating that fires typically burned the riparian areas with comparable frequency (Olson, 2000). Fire Regime 1 is characterized by low fire return intervals and low-mixed severity fire (less than 75% of dominant over story vegetation replaced). Based on fire history studies by Heyerdahl and Agee (1996) in the Blue Mountains, and Olson (2000) within riparian habitats in these landscapes, fire return intervals were 13-36 years. Because these forests had more frequent fire return intervals, with the advent of fire suppression these portions of the forest tend to be the furthest departed from the Historical Range of Variation (HRV). Condition Class is a way to express this departure from HRV.

Condition Class

Fire regime condition classes reflect the current conditions' degree of departure from modeled reference conditions. FRCC assessments measure departure in two main components of ecosystems: 1) fire regime (fire frequency and severity) and 2) associated vegetation. Recent analyses have classified the Umatilla National Forest by condition class (Table 1).

Table 1: Existing condition class for the Umatilla National Forest.

Condition Class	Existing Condition (acres)	Existing Condition (percent)
1	415,000	29%
2	279,000	20%
3	684,000	49%

Condition Class 1 represents ecosystems with low (<33 percent) departure; Condition Class 2 indicates ecosystems with moderate (33-66 percent) departure; and Condition Class 3 indicates ecosystems with high (>66 percent) departure. 69% of the Umatilla National Forest is in CC2 and CC3. Condition classes also represent increasing levels of risk from uncharacteristic wildland fire behavior and effects.

Desired Future Condition

The desired future condition is that all riparian zones would be in and maintained in condition class 1. Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression). Composition and structure of upland and riparian vegetation and fuels characteristics are similar to the conditions that existed under the historical fire regime. Risk of loss of key ecosystem components is reduced.

3.9.4 Alternative l- Environmental Effects -Fire and Fuels

There would be no changes in vegetation species composition, structure or density within riparian areas from aquatic restoration activity. No juniper removal would be implemented, therefore juniper encroachment into riparian areas would continue. No prescribed fire would be introduced into riparian areas, so restoration of dry forest riparian species would not occur. Vegetative stands would continue to succeed towards Condition Class III, allowing for increased chance of severe fires and reduction in plant diversity across the Forest. Both would result in continued degradation of riparian zones.

On the Umatilla National Forest other vegetation management projects may occur and include PDCs #13 and # 14 type activities in riparian areas. However, there are no known or reasonably foreseeable future projects that overlap with the Proposed Action for this project and other projects on the Umatilla National Forest.

3.9.5 Alternative 2- Environmental Effects – Fire and Fuels

The effects of implementing activities # 13 and # 14 will be described as either restoring or maintaining the riparian ecosystems within a historic range of variation.

Treatments in areas classified as condition class 2 or 3 would have an effect of restoring fuels conditions back to historic variability. Treatment objectives would be to reduce surface fuel loads and kill above ground vegetation redistributing resources (light and water) toward the growth of riparian plant communities. Killing vegetation whether by saw, masticator or prescribed fire redistributes fuel. A short term decrease in 0-3 inch fuels will occur as these surface fuels are consumed. Fire killed conifers will begin to increase surface fuels over time. To meet forest standards and prescribed fire objectives a thinning or piling treatment may be needed pre burn. Snags will be created. In the long term large woody debris (boles of trees) would increase do to decomposition. Standing snags will convert to down woody debris over the long term. The availability or increase in groundwater would return a microclimate in which fire behavior (intensity and severity) would be more in line with historic conditions.

Treatment areas classified as condition class 1 would have an effect of preserving the fuels conditions or rather simulating the effects of a natural fire return interval. Riparian species exhibit a range of adaptations to disturbance that contribute to the rapid recovery of streamside habitats following fire. These include adaptations that facilitate the survival of plants on site, such as sprouting and thick bark, and those that contribute to recolonization of burned sites, including wind and water dispersal, reproductive responses, and the capacity to establish in post fire environments (Stickney, 1986); (Kauffman J. , 1990); (Miller, 2000). As was discussed earlier these systems experienced 12 year mean fire return intervals. Carefully applied prescribed fire may be the most appropriate treatment in riparian areas that historically burned frequently ((Kauffman J. B., 1997); (Agee J. K., 1999); (Everett, 2003)).

The effect of both treatment types above will be commensurate to the amount of acres treated. The more acres treated the greater the effect they will have. Furthermore the percentage of acres treated within a watershed the greater the effect the treatment will have on that watershed.

Cumulative Effects- Fire and Fuels

The existing condition is the culmination of past and present activities. The effects of proposed activities, reduction of juniper and introduction of prescribed fire, would be an overall improvement of fuel characteristics. Potential for uncharacteristically severe and system damaging fires would be decreased.

3.9.6 Summary of Environmental Effects - Fire and Fuels

Proposed treatments comply with relevant laws, regulations, policies, and Forest Plan. Present conditions show that significant changes have occurred in the fuel characteristics at the landscape level. Prescribed fire and juniper removal and their related design criteria will improve the fuel characteristics within riparian areas. Changing these characteristics will allow the system to respond within the natural range of variation with future disturbances, not eliminate them. In fact the goal would be for disturbances, specifically wildland fire, to continue to play a role in these systems.

3.10 Air Resource

The air resource analysis focuses on potential change as they relate to activity category #14 Riparian Vegetation Treatment (prescribed fire) adjacent or near stream channels. It is unlikely that individual prescribed fires will occur within riparian corridors without also including the adjacent uplands. Discussing the upland areas is outside of the scope of this analysis.

Implementing prescribed fire would result in production of smoke into the air and impact the production of smoke in future wildland fires. This section will analyze potential short or long term impacts to air quality.

3.10.1- Relevant Laws, Regulations, Policies, Guidance, and Plans

The Umatilla National Forest Land and Resource Management Plan 1990 as amended (LRMP) provides standards and guidelines for air quality management. Other regulations and policies considered in this analysis include:

- Federal Clean Air Act (Public Law 95-95)
- National Ambient Air Quality Standards
- State of Oregon and Washington Smoke Management Plans
- Smoke Management Guide for Prescribed and Wildland Fire
- Interagency Prescribed Fire implementation Guide

3.10.2 Methodology- Air Resource

Smoke production will indicate the effect prescribed burning will have on air quality. Air quality will be measured by the amount of particulate emissions, tons/acre. Air Quality regulations within the Clean Air Act guide the production of smoke through human management actions.

3.10.3 Affected Environment – Air Resource

As an ecological process, wildland fire is essential in creating and maintaining functional ecosystems and achieving other land use objectives. As a decomposition process, wildland fire produces combustion byproducts that are harmful to human health and welfare.

Smoke is a mix of particulate matter and gases. These include nitrogen dioxide, ozone, carbon monoxide, polycyclic aromatic hydrocarbons and volatile organic compounds. The major pollutant of concern in smoke from wildland fire is fine particulate matter, both PM_{10} and $PM_{2.5}$. Eighty to ninety percent of wildland fire smoke is within the fine particle size class ($PM_{2.5}$), making public exposure to smoke a significant concern, especially for sensitive populations. For example the elderly, young and people with preexisting conditions. Particles can irritate the eyes, nose, throat and respiratory system, and can be inhaled into the deepest part of the lungs. Once smoke enters the atmosphere, its concentration at any one place or time depends on mechanisms of transport and dispersion.

Air Quality is the composition of air with respect to quantities of pollution therein; used most frequently in connection with standards of maximum acceptable pollutant concentrations. Air quality is a measure of the direct effect of smoke.

Table 2: National Ambient Air Quality Standards for Particle Pollution

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Particle Pollution	$PM_{2.5}$	primary	1 year	12.0 µg/m3	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35.0 µg/m3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 µg/m3	Not to be exceeded more than once per year on average over 3 years

Visibility & Haze are impacted by smoke production and must be considered in the management of smoke. Many factors impact visibility within an airshed and it can be difficult to correlate effects of prescribed fire. Clean Air Act (1977 amendment) established the goal of "the prevention of any future, and remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution" (Public Law 95-95). Visibility impairment is the indirect effect of smoke.

No Class I Airsheds lie within the bounds of the Umatilla National Forest. There are however three Class I airsheds that are relatively adjacent to the Umatilla National Forest; they are, Eagle Cap Wilderness. Strawberry Mountain Wilderness and the Hells Canyon National Recreation Area.

The surrounding communities of Pendleton, Enterprise, La Grande, and Baker City are listed in the Oregon State Smoke Management Plan as Smoke Sensitive Receptor Areas and thus protected by the highest standards in the plan. Washington State Management Plan describes sensitive areas but does not list them. Sensitive areas in Washington are areas of heavy recreational use and population centers outside designated areas. Population centers that prescribed fire emissions may in pact in Washington are Walla Walla/College Place, Waitsburg, Dayton, Pommeroy, and Clarkston.

On the Umatilla some generalities can be observed about weather patterns. The prevailing winds are from the southwest and west. During the day air is forced up valley and up slope. During the night, air flows down drainages. Inversions are typical and can trap smoke in low lying areas. Smoke managers must consider these and localized weather conditions to minimize the impact to smoke sensitive areas. Prescribed fire within riparian areas would emit smoke at lower elevations and smoke dispersion would be effected by the above mentioned terrain influences.

Several management techniques would be implemented to limit air quality impacts. The use of prescribed fire in this area would create a short-term smoke impact. Prescribed burns would be planned so that factors such as wind direction and air mass stability would help limit the effects of smoke (e.g. smell, eye irritation) on local residents, campers, or the general public. A Prescribed Fire Plan will be

developed prior to ignition and will adhere to the Interagency Prescribed Fire Planning and Implementation Procedures Guide. Prescribed burning in the Glass project area would follow smoke management forecasts obtained prior to ignition. Smoke forecast direction would be followed during implementation of prescribed fires. Smoke management forecasts are available daily during normal prescribed fire seasons in the spring and fall, and information and direction is available to implementation personnel by calling the smoke management forecaster.

The following prescribed burning techniques could be used, where appropriate, to minimize smoke emissions and assure that emission objectives are met:

(a) Avoid burning when air stagnation advisories are in effect, during pollution episodes, or when temperature inversions exist

(b) Design burning activities to utilize climatic conditions which favor rapid smoke dispersion

(c) Burn under favorable moisture conditions, utilizing guides developed by PNW Forest Fire Science Library

(d) Accomplish mop-up quickly to reduce residual smoke

(e) Design ignition method and firing technique to aid dispersion

(f) Use smoke models to predict impacts including plume trajectory

Prescribed fires wholly within riparian areas would likely be relatively small. For example a .25 mile segment of a stream with a buffer of 300 feet on either side would be approximately 18 acres in size. Unit's total emissions would therefore be relatively low. Experience has shown that

3.10.4 Alternative l- Environmental Effects - Air Resource

Wildfire burning under the existing and future conditions could have the potential to produce smoke levels that exceed visual and health standards. Local research found PM_{10} smoke production was twice as high for wildfires as for prescribed fire. This is due to wildfires generally occurring during the driest periods of the year in which there are low fuel moistures. Lower fuel moistures means there is more fuel available for combustion.

Research in the Grande Ronde River Basin found the following levels of PM_{10} smoke emissions (Huff, et al., 1995)

- Wildfire: 0.318 tons or 635 pounds per acre
- Prescribed Burning: 0.167 tons or 334 pounds per acre

Emissions and smoke from wildfires would most likely occur in patterns similar to current conditions. During the 2017 fire season, parts of Oregon experienced Hazardous levels of smoke. In all, about 160 days reached a level considered unhealthy for sensitive groups.

It is important to note that while wildfire events have the potential to degrade air quality they are not regulated. Under alternative 1 there would be no production of smoke so there would be no impact to air quality.

3.10.5 Alternative 2- Environmental Effects – Air Resource

Air quality will be temporarily directly affected through prescribed burns. It is unknown the scale of impacts. Size of prescribed fire units, location of units, fuel loadings, fuel moistures and atmospheric conditions within those units are unknowns at this time. However, it is reasonable to conclude that meeting project design features, including development of burn plans and requirements, that low-severity burns and limited moderate severity burns used will decrease emissions.

There are two general approaches to managing the effects of wildland fire smoke on air quality:

1. Use techniques that reduce emissions produced for a given area treated.
2. Redistribute the emissions through meteorological scheduling and by sharing the airshed.

Emission reduction techniques must be prescribed to the localized area and in project level prescribed fire plans. Effects are expected to be localized. National, state, and local policies regarding prescribed fire implementation, including smoke management, will be met.

Cumulative Effects- Air Resource

The air resource is shared at a large scale. The effect of one management action such as prescribed fire is cumulative in nature. The smoke produced from an event combines with many other sources of air pollutants. In the west many managers are looking at similar time frames and weather parameters to carry out prescribed fires. These inevitabilities are managed at the state level. State agencies look at weather conditions, where burns are planned, and how much smoke is likely to be produced. They then give a go no go decision for each prescribed fire. Each land manager must accurately depict the amount of emissions there action is likely to produce and get that data to the regulatory agency.

3.10.6 Summary of Environmental Effects - Air Resource

Fuel treatments under Alternative 2 would have a short-term reduction in air quality. At the same time the reduction of fuels and the increase in riparian vegetation has the potential to decrease the amount of smoke produced by future unplanned or planned ignitions. Smoke can be managed. A well thought out prescribed fire plan can communicate burn objectives and estimations of emissions.

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